

samples brought back from atomic weapons testing. This material was considered “AEC material” and, while not specifically licensed, was subject to strict controls under the AEC and the Armed Forces Special Weapons Program.

Machines that produce ionizing radiation were used by the shipyard and NRDL. Generally, these machines did not use radioactive material or produce radioactive contamination. Controls for these types of equipment generally followed manufacturer’s guidelines with the additional implementation of standard Navy requirements.

Use of non-AEC licensed materials and machine sources of ionizing radiation used by the shipyard and NRDL are described below.

5.4.1 HPS

NORM and non-specifically AEC controlled or licensed radioactive materials were used throughout the shipyard in commodity items. Specific examples include smoke detectors containing (americium-241 [Am-241]), exit signs (tritium [H-3]), sound-powered telephone jacks (Ra-226), deck markers (Ra-226 and strontium-90 [Sr-90]), electron tubes (many different radionuclides), thoriated welding rods (thorium-232 [Th-232]), divers’ watches (Ra-226, H-3, and Pm-147), wristwatches and compasses (Ra-226, H-3, and Pm-147), and radiation detection equipment check sources (mainly cesium-137 [Cs-137], Sr-90, and Ra-226). Formalized controls for these items were not found, which is common because these controls were not typically warranted during the operational time of HPS.

Controlled disposal of radioactive commodity items began in the late 1960s when the Navy instituted a program to control devices containing Ra-226 that included removal of radium devices from ships and replacement with non-radium substitutes (HRA-2932). In compliance, HPS implemented procedures for removal and control of devices containing radium (HRA-2811). Gradually, the Navy expanded the control program to include all commodity items containing radioactive material. Prior to the implementation of the control programs, HPS likely disposed of these items as normal trash in the Landfill Area (IR-01/21) or Bay Fill Area (IR-02). Disposal of these items in commercial landfills was common practice by private industry as well.

calibrated its own inventory of RADIACs. Ensuring a RADIAC's detection accuracy requires periodic calibration with a certified radiation source of a known quantity and frequent response checks using smaller sources.

In the early days of RADIAC use (the late 1940s and early 1950s), instrument calibration was done using a radioactive source in a lead-shielded container commonly referred to as a "pig." Calibration points were at measured distances from the pig with the door of the pig open to expose the source. An area on a floor would be painted to mark the levels a RADIAC should read at specific distances from an exposed source. This area was called a "calibration range." To calibrate an instrument, a technician would place it at the required calculated distance, open the door of the pig, and adjust the instrument to read the appropriate radiation level. As of this writing, the remains of calibration distance markings can still be seen on the third floor of Building 253, although the source and its pig are gone.

Specially designed calibrators replaced the primitive use of a source in a pig as technologies improved. These calibrators used various sealed sources, primarily Cs-137, Co-60, plutonium-239 (Pu-239), or Th-232, in specially designed shielded assemblies. These sources were licensed by the AEC and were routinely checked for leakage of radioactivity. If leakage was found, the calibrator would be removed from service until the source was repaired or replaced. If a source could not be repaired, it was disposed of as radioactive waste. All sources were either transferred to other licensed users or disposed of off site as radioactive waste when the shipyard closed. The AEC licenses held by the shipyard for the calibrators are detailed in Section 5.0. Available records indicate that calibration facilities used by the shipyard were maintained in Building 253 (HRA-601, p 8).

Small check sources were available for checking the proper operation of RADIACs in the field. These were usually small sealed sources of a certified quantity of radioactive material, generally called check sources. Radionuclides commonly used for check sources were Cs-137, Co-60, Ra-226, and Th-232. Some of the check sources were maintained with the RADIAC and some were contained in source sets that allowed users to check the instrument for response to different types of radiation and the accuracy of that response. Most of the check sources did not

require AEC licensing. These sources were disposed of off site as radioactive waste when they were no longer useful (HRA-1044).

6.1.4 Decontamination of Ships

The drydock facilities of the shipyard were used in the late 1940s for decontamination of OPERATION CROSSROADS ships and periodically through the 1950s and 1960s for the decontamination of ex-GRANVILLE S. HALL (Miscellaneous Auxiliary Service Craft [YAG]-39) and ex-GEORGE EASTMAN (YAG-40). YAG-39 and YAG-40 were ex-Liberty ships specially modified to NRDL specifications to provide support for research during weapons tests in the Pacific. These vessels were decontaminated by the shipyard work force under the direction of NRDL. The details of OPERATION CROSSROADS decontamination efforts are in Section 6.2. The ships' use and decontamination are detailed in Section 6.3.

6.1.5 Non-Licensed Radioactive Commodities

Additional radioactive materials were commonly used throughout the shipyard in commodity items. These items include smoke detectors (Am-241), exit signs (H-3), electron tubes (variety of radionuclides), night vision equipment (Th-232), and thoriated tungsten welding rods (Th-232). Safety devices (smoke detectors and exit signs) remain in shipyard buildings today.

6.1.6 Triple A

From 1976 through 1986, major portions of the shipyard were leased to Triple A, a shipbuilding and repair company. Triple A did not possess radioactive materials licenses and likely subcontracted operations that required the use of licensed materials, such as gamma radiography (HRA-2909). It is possible, based on the time period of Triple A operations, that shipboard devices containing Ra-226 and/or Sr-90 were removed and disposed of at the shipyard by Triple A. No historical documentation has been found that details Triple A radiological operations at the shipyard.

Though their lease expired in December 1986, Triple A did not vacate the shipyard until March 1987. During its tenure at the yard, Triple A sublet various buildings and grounds to a